## ENDL TEXAS

Date: 5 January 2003 To: T10 Technical Committee From: Ralph O. Weber Subject: Remove ULP and LLP from SAM-3

SAM-2 Letter Ballot comment HP 71 expressed a concern long held by the SAM-2/3 editor, to whit:

"The entire reference to ULP and LLP should be dropped, to avoid using multiple names for the same layer - which the current discussion does. I would have understood if ULP is used to simply indicate a higher layer wrt the one below (generically to represent either application-to-protocol, or protocol-to-interface), but defining ULP=application seems inviting redundancy for no reason."

The response recorded for HP 71 in 02-155r6 defers changes to SAM-3. A review of the front matter in SAM-3 r04 will evidence my long standing desire to eliminate the use of LLP as an acronym for SCSI Transport Protocol Layer and ULP as an acronym for SCSI Application Layer. This proposal describes the specific changes necessary to accomplish that end.

## **Revision History**

r0 Initial proposal

## **Specific Changes**

All references are to SAM-3 r04.

Change 1 [Glossary & Acronyms]: Modify the following glossary entries in 3.1 as shown:

**3.1.66 lower level protocol (LLP):** A protocol used to carry the information representing upper level protocol transactions.

**3.1.90 SCSI application layer (SAL):** The protocols and procedures that implement or issue SCSI commands and task management functions by using services provided by a SCSI transport protocol layer.

**3.1.105 SCSI transport protocol layer (STPL):** The protocol and services used by a SCSI application layer to transport data representing a SCSI application protocol transaction.

**3.1.106 SCSI transport protocol service confirmation:** A signal from the lower level SCSI transport protocol layer STPL notifying the upper layer SAL that a SCSI transport protocol service request has completed.

**3.1.107 SCSI transport protocol service indication:** A signal from the lower level SCSI transport protocol layer STPL notifying the upper level that a SCSI transport protocol transaction has occurred.

**3.1.108 SCSI transport protocol service request:** A procedure call to the lower level SCSI transport protocol layer STPL to begin a SCSI transport protocol service transaction.

**3.1.109 SCSI transport protocol service response:** A procedure call to the STPL containing a reply from the upper level protocol layer SAL in response to a SCSI transport protocol service indication.

**3.1.137 upper level protocol (ULP):** An application-specific protocol processed through services provided by a lower level protocol.

Add and remove the following acronyms entries in 3.2 as shown:

- LLP Lower Level Protocol (see 3.1.66)
- SAL SCSI application layer (see 3.1.90)
- STPL SCSI transport protocol layer (see 3.1.105)
- ULP Upper Level Protocol (see 3.1.137)

Change 2 [5.4.3.1 3 Data transfer SCSI transport protocol services introduction]: Modify the second to last paragraph in the subclause as follows:

The LLP STPL confirmed services specified in 5.4.3.2 and 5.4.3.3 are used by the device server to request the transfer of command data to or from the application client. The SCSI initiator device SCSI transport protocol service interactions are unspecified.

Change 3 [4.14 The SCSI model for distributed communications]: Revise the entire subclause as follows:

## 4.14 The SCSI model for distributed communications

The SCSI model for communications between distributed objects is based on the technique of layering as shown in figure 25.



Figure 25 — Protocol service reference model

The layers comprising this model and the specifications defining the functionality of each layer are denoted by horizontal sequences. A layer consists of peer entities that communicate with one another by means of a protocol. Except for the interconnect layer, such communication is accomplished by invoking services provided by the adjacent lower layer. By convention, the layer from which a request for service originates is called the upper level protocol layer or ULP layer. The layer providing the service is referred to as the lower level protocol layer or LLP layer. The following layers are defined.

**SCSI application layer (SAL):** Contains the clients and servers that originate and process SCSI I/O operations by means of a SCSI application protocol;

SCSI transport protocol layer (STPL): Consists of the services and protocols through which clients and servers communicate; and

**Interconnect layer:** Comprised of the services, signaling mechanism and interconnect subsystem needed for the physical transfer of data from sender to receiver. In the SCSI model, the interconnect layer is known as the service delivery subsystem.

The set of protocol services implemented by the service delivery subsystem are intended to identify external behavioral requirements that apply to SCSI transport protocol standards. While these protocol services may serve as a guide for designing reusable software or firmware that is adaptable to different SCSI transport protocols, there is no requirement for an implementation to provide the service interfaces specified in this standard.

The protocol service interface is defined in this standard in representational terms using protocol services. The protocol service interface implementation is defined in each SCSI transport protocol standard. The interconnect service interface is described as appropriate in each SCSI transport protocol standard.

Interactions between the ULP SAL and LLP STPL layers are defined with respect to the ULP SAL layer and may originate in either layer. An outgoing interaction is modeled as a procedure call invoking an LLP STPL service. An incoming interaction is modeled as a signal sent by the STPL LLP layer that may be accompanied by parameters or data. Both types of interaction are described using the notation for procedures specified in 3.6.2. In this model, input arguments are defined relative to the layer receiving an interaction (i.e., an input is a parameter supplied to the receiving layer by the layer initiating the interaction).

The following types of service interactions between layers are defined:

**SCSI transport protocol service request:** A request from the SAL ULP layer invoking a service provided by the STPL LLP layer.

**SCSI transport protocol service indication:** A signal from the STPL <u>LLP layer</u> informing the SAL <u>ULP layer</u> that an asynchronous event has occurred (e.g., a reset or the receipt of a peer-to-peer protocol transaction).

**SCSI transport protocol service response:** A call to the STPL <u>LLP layer</u> invoked by the SAL <u>ULP layer</u> in response to a SCSI transport protocol service indication. A SCSI transport protocol service response may be invoked to return a reply from the invoking <u>ULP SAL</u> to the peer SAL <u>ULP peer</u>.

**SCSI transport protocol service confirmation:** A signal from the STPL <u>LLP layer</u> notifying the SAL <u>ULP layer</u> that a SCSI transport protocol service request has completed, has been terminated, or has failed to transit the interconnect layer. A confirmation may communicate parameters that indicate the completion status of the SCSI transport protocol service request or any other status. A SCSI transport protocol service confirmation may be used to convey a response from the <u>ULP SAL</u> peer.

The services provided by an STPL <u>LLP layer</u> are either confirmed or unconfirmed. A <u>ULP SAL</u> service request invoking a confirmed service always results in a confirmation from the STPL <u>LLP layer</u>.



Figure 26 shows the relationships between the four protocol service types.

Figure 26 — Protocol service model

Figure 27 shows how protocol services may be used to process a client-server request-response transaction at the SCSI application layer.



Figure 27 — Request-Response ULP SAL transaction and related LLP STPL services

The dashed lines in figure 27 show a SCSI application protocol transaction as it may appear to sending and receiving entities within the client and server. The solid lines in figure 27 show the corresponding SCSI transport protocol services and LLP STPL transactions that are used to transport the data.